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**Index terms:**

Breast, biopsy, 01.1261  
Breast neoplasms, surgery, 00.44

**Published online**

10.1148/radiol.2292021594  
Radiology 2003; 229:541-544

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## Clip or Marker Migration 5-10 Weeks after Stereotactic 11-gauge Vacuum-assisted Breast Biopsy: Report of Two Cases<sup>1</sup>

Two women, aged 50 and 51 years, underwent stereotactic, 11-gauge vacuum-assisted biopsy from the cranial approach of small lesions in the upper outer quadrant of the right breast with removal of lesions that were detected with mammography. Postbiopsy mammograms showed the metal clip or marker at the biopsy sites in both patients. Histologic analysis of both lesions indicated atypical hyperplasia. Mammograms obtained prior to surgical excision showed caudal z-axis migration of the clip or marker to be 6.5 cm at 5 weeks and 4.5 cm at 10 weeks, respectively. By ignoring the clip or marker that had migrated to an inaccurate location and by using internal and external breast landmarks to guide presurgical excision needle localization, the biopsy sites were successfully excised in both patients.

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Percutaneous stereotactic breast biopsies are increasingly being performed with an 11-gauge vacuum-assisted technique to increase histologic accuracy. This results in complete removal of many lesions, as assessed with mammography, (1-3) but does not guarantee complete removal, as assessed with histology (1,3). To aid presurgical excisional localization of malignant and high-risk lesions in need of surgical excision, a clip or marker is placed at the biopsy site when the mammographic lesion is no longer definitively seen or when the operator thinks the lesion may be difficult to find after biopsy. The initial placement of the clip or

marker is usually in close proximity to the biopsy cavity but can be in a remote location (4-11). Few researchers have evaluated the relative long-term stability of clip or marker placement (4,12). Two case reports describe migration of a clip seen at initial mammographic follow-up of benign lesions 10-12 months after stereotactic 11-gauge vacuum biopsy (13,14).

Through January 2003, we have performed 4,448 stereotactic biopsies at two medical institutions with use of a prone biopsy table (Mammotest; Fischer Imaging, Denver, Colo). Biopsies of 3,531 (79%) lesions were performed with an 11-gauge vacuum-assisted biopsy device (Mammotome; Ethicon Endo-Surgery, Cincinnati, Ohio). After 11-gauge biopsy, a clip or marker was placed in 2,065 (58%) of these lesions.

We describe different types of percutaneously placed clips and markers with short-term migration noted at the time of presurgical excision needle localization for atypical hyperplasia lesions 5-10 weeks after stereotactic 11-gauge vacuum-assisted biopsy. Because of inaccurate clip or marker position and complete removal of the sampled lesion, as assessed with mammography, other mammographic landmarks were used to guide presurgical needle localization. After consultation with our Institutional Review Board, neither their approval nor informed consent were required for this study.

### 1 Case Report 1

A 50-year-old premenopausal woman was placed in the prone position and underwent uncomplicated stereotactic biopsy of a 10 × 12-mm indistinct mass in the upper outer quadrant of the scattered fibroglandular tissue of the right breast. Biopsy was performed with a cranial ap-

**Author contributions:**

Guarantors of integrity of entire study, R.B., R.J.; study concepts and design, R.B., R.J.; literature research, R.B., R.J.; clinical studies, R.B., R.J.; data acquisition and analysis/interpretation, R.B., R.J.; manuscript preparation, definition of intellectual content, editing, revision/review, and final version approval, R.B., R.J.

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proach in the craniocaudal projection by using an 11-gauge vacuum-assisted biopsy device (Mammotome; Ethicon Endo-Surgery). Sixteen samples were taken. Since the mass was no longer seen with assurance on prone stereotactic images at completion of the biopsy, a metal clip (MicroMark; Ethicon Endo-Surgery) was placed through the vacuum probe by a radiologist (R.J.J.) who has performed 887 clip or marker placements. Postprocedural stereotactic images obtained in the prone position and craniocaudal and lateral mammograms obtained in the upright position both showed the clip to be within 5 mm of the center of the biopsy site in the upper outer quadrant of the right breast and apparently adherent to tissue in the 12-o'clock portion of the biopsy cavity. Histologic analysis revealed atypical ductal hyperplasia and lobular carcinoma in situ, and surgical excision was recommended.

Five weeks after the vacuum-assisted biopsy, mammography was performed in the craniocaudal and lateral views prior to needle localization and surgical excision. The mammogram showed the percutaneously placed clip was now in the lower outer quadrant of the breast. No apparent migration was seen on the craniocaudal mammogram, but the clip had migrated 6.5 cm in the caudal direction on the lateral mammogram (Fig 1). By using all available external and internal mammographic landmarks, a localizing needle was placed at the prior vacuum site and surgical excision was performed. The clip was left in the breast. Histologic analysis of the surgically excised specimen revealed extensive involvement of ductal carcinoma in situ that extended to the margins of the excised specimen and verified removal of the vacuum-assisted biopsy site. When a larger lumpectomy-procedure performed later also revealed extensive ductal carcinoma in situ involving the specimen margins, the patient chose to undergo bilateral mastectomy.

## Case Report 2

A 51-year-old premenopausal woman was placed in the prone position and underwent uncomplicated stereotactic biopsy of a 3 × 4-mm cluster of pleomorphic calcifications in the upper outer quadrant of the heterogeneously dense right breast. Biopsy was performed with a cranial approach in the craniocaudal projection by using an 11-gauge vacuum-assisted biopsy device (Mammotome;

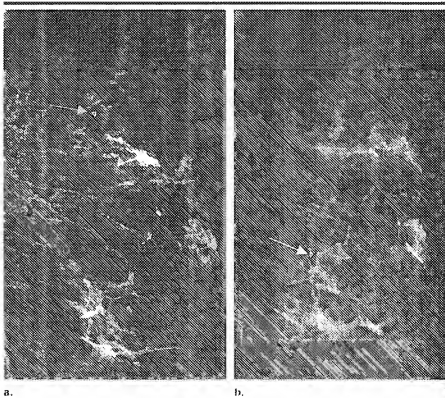


Figure 1. Case 1. Mammograms of a 50-year-old woman who underwent vacuum-assisted biopsy for a small indistinct mass in the upper outer quadrant of the right breast that was diagnosed as atypical ductal hyperplasia and lobular carcinoma in situ. (a) Initial postprocedure lateral mammogram demonstrates accurate clip placement (arrow). (b) Pre-needle localized surgical biopsy lateral mammogram obtained 5 weeks later demonstrates 6.5-cm caudal clip migration (arrow).

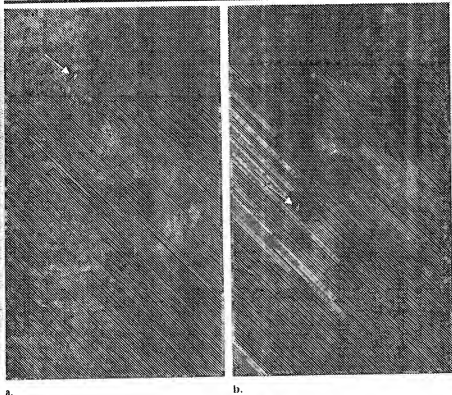
Ethicon Endo-Surgery). Sixteen samples were taken, and removal of the calcifications was confirmed with a radiograph of the specimen. Since the calcifications were no longer seen on stereotactic images obtained in the prone position at the completion of biopsy, a marker consisting of seven gelatin pledgets, one of which contained a metal wire (Gel Mark; SenoRx, Aliso Viejo, Calif), was placed through the vacuum probe by a radiologist who has performed 417 clip and marker placements. Postprocedural stereotactic images obtained in the prone position and craniocaudal and lateral mammograms obtained in the upright position both showed the metal part of the marker at the center of the biopsy site, apparently within the biopsy cavity. Histologic analysis revealed atypical lobular hyperplasia, and surgical excision was recommended.

Mammography was performed in the craniocaudal and lateral planes 10 weeks after the vacuum-assisted biopsy and prior to needle localization and surgical excision. Mammography indicated the percutaneously placed marker was now in the lower outer quadrant. No apparent

migration was seen on the craniocaudal image, but the marker had migrated 4.5 cm in the caudal direction on the lateral image (Fig 2). By using all available external and internal mammographic landmarks, two localizing needles were placed to bracket the site of prior vacuum-assisted biopsy, and a surgical excision was performed. The marker was left in the breast. Histologic analysis of the surgical specimen revealed atypical lobular hyperplasia without malignancy and verified that the vacuum-assisted biopsy site had been removed. Mammographic follow-up was recommended.

## Discussion

Accuracy of needle-localized surgical breast biopsy is dependent on exact positioning of the localizing needle at the lesion site (15). If the mammographic lesion is completely removed with vacuum-assisted biopsy, accurate placement of a clip or marker at the biopsy site will facilitate accurate placement of the localizing needle in those lesions that require



**Figure 2.** Case 2. Mammograms of a 51-year-old woman in whom atypical ductal hyperplasia was diagnosed with vacuum-assisted core biopsy. (a) Initial postprocedure lateral mammogram demonstrates accurate marker placement (arrow). (b) Ten weeks after core biopsy, pre-surgical biopsy lateral mammogram demonstrates 4.5-cm caudal marker migration (arrow).

surgical excision. In addition, accurate clip or marker placement focuses attention at mammographic follow-up on the biopsy sites of benign lesions that do not require surgical excision.

Both the MicroMark clip and the Gel Mark marker are deployed at the percutaneous biopsy site after extraction of tissue and before release of compression. Both the clip and the metal portion of the marker measure about 2 mm in diameter and are made of stainless steel that should be visible on mammograms for the life of the patient. The seven gelatin pellets of the marker are visible on ultrasonographic (US) images for up to 20 days after the biopsy (12). Placement of the clip or marker through the indwelling probe follows vacuum suction, which clears tissue fragments and blood from both the biopsy probe and the biopsy cavity, and probe withdrawal of 5 mm. The clip is deployed during simultaneous vacuum suction that collapses the cavity, and it is designed to attach to the wall of the cavity. The marker is deployed without simultaneous use of vacuum suction, and it is designed to stay in the biopsy cavity.

Accuracy of initial clip placement after 11-gauge vacuum-assisted biopsy has been studied with stereotactic-guided biopsy (4–8) and US-guided biopsy (9). While the clip is usually in close proximity to the biopsy site, it sometimes can be in a remote location several centimeters away. Stereotactic images obtained immediately after clip placement with the breast still in compression are used to verify clip deployment (4–7) and to compare the z-axis position of the clip with the lesion (5,6). The difference in z-axis position of the lesion and the clip may cause underestimation of the inaccuracy of clip position that will be appreciated once compression is released because of the “accordion effect” (4,5,7,8). It is suggested that when the breast is released from compression, the clip can move away from the biopsy site. Movement usually occurs along the axis of needle insertion (z axis) and can be either toward or away from the skin entry site (5,6).

Accuracy of initial placement of the metal portion of the marker after 11-gauge vacuum-assisted biopsy has been studied (10,11). Initial placement was

said to be more accurate with the marker (10,11) than with the clip (4,10). Good, relatively long-term stability was reported with both the clip (4) and the marker (12) in a limited number of patients.

To our knowledge, there are only two other case reports of migration of a clip, and both were noted at mammographic follow-up of benign lesions 10–12 months after stereotactic 11-gauge vacuum-assisted biopsy (13,14). We are unaware of any reports of migration of a marker.

In our two patients, clip or marker migration was apparent at the time of pre-needle localization and surgical excision of atypical hyperplasia lesions 5–10 weeks after stereotactic 11-gauge vacuum-assisted biopsy. We generally advise surgical excision of both atypical ductal hyperplasia lesions (16) and atypical lobular hyperplasia lesions (17,18) that were diagnosed with percutaneous biopsy. We used a clip in one patient and a marker in the other.

If a malignant or high-risk lesion in need of surgical excision has been diagnosed at percutaneous biopsy, we focus surgical excision on the percutaneous biopsy site. If the clip or marker is in close proximity to the biopsy cavity, it can guide pre-surgical excision localization and will be removed from the specimen. If the clip or marker is in a remote position, however, as was the case in our two patients, we focus pre-surgical excision localization on the percutaneous biopsy site rather than on the clip or marker.

We obtain orthogonal mammograms in the upright position immediately prior to needle localization if placement of the clip or marker is known to be inaccurate, if mammograms obtained in the upright position immediately after the vacuum-assisted biopsy are not available, or, occasionally, to look for any residual mammographic evidence of the lesion that was sampled.

There are several factors to be considered in the course of needle localization when clip or marker position is inaccurate. If there is any residual part of the sampled lesion that is mammographically evident, we use the residual lesion to guide localization. Barring that, we perform needle localization by using all available mammographic landmarks, including the nipple, skin, calcifications, masses, vessels, and pattern of fatty and fibroglandular tissue (19). We have found that air in the breast after a percutaneous biopsy is often remote from the biopsy site, even on images obtained immedi-

ately after biopsy, and is not a reliable landmark for identification of the biopsy site. Whatever course is taken must result in accurate needle position and eventual surgical removal of the vacuum-assisted biopsy site. The fact that the percutaneous biopsy cavities were histologically found in our two surgically excised specimens suggests our localizations and subsequent surgical excisions were accurate. The histologic findings at surgery were compared with the findings at the percutaneous biopsy site and support that supposition.

In conclusion, if there is clip or marker migration and no residual mammographic lesion, we compare orthogonal mammograms obtained in the upright position before vacuum-assisted biopsy and after needle localization to ensure accuracy in the guidance of surgical excision. We try to identify the percutaneous biopsy site in the excised specimen and to correlate histologic findings in the surgical specimen with those at percutaneous biopsy to determine if the correct tissue was removed at surgery.

# References

- Liberman L, Dershaw DD, Rosen PP, Morris EA, Abramson AF, Rouge P. Percutaneous removal of malignant mammographic lesions at stereotactic vacuum-assisted biopsy. *Radiology* 1998; 206:711-715.
- Jackman RJ, Marzoni FA, Nowels KW. Percutaneous removal of benign mammographic lesions: comparison of automated large-core and directional vacuum-assisted stereotactic biopsy techniques. *AJR Am J Roentgenol* 1998; 171:1425-1430.
- Liberman L, Kaplan JB, Morris FA, Abramson AF, Maxwell H, Dershaw DD. To excise or to sample the mammographic target: what is the goal of stereotactic 11-gauge vacuum-assisted breast biopsy? *AJR Am J Roentgenol* 2002; 179:679-683.
- Burbank F, Forcier N. Tissue marking clip for stereotactic breast biopsy: initial placement accuracy, long-term stability, and usefulness as a guide for wire localization. *Radiology* 1997; 205:407-415.
- Liberman L, Dershaw DD, Morris FA, Abramson AF, Thornton CM, Rosen PP. Clip placement after stereotactic vacuum-assisted breast biopsy. *Radiology* 1997; 205:417-422.
- Reynolds HE. Marker clip placement following directional vacuum-assisted breast biopsy. *Am Surg* 1999; 65:59-60.
- Rosen EL, Thuy T. Metallic clip deployment during stereotactic breast biopsy: retrospective analysis. *Radiology* 2001; 218:510-516.
- Kruger BM, Borrowes P, MacGregor JH. Accuracy of marker clip placement after Mammotome breast biopsy. *Can Assoc Radiol J* 2002; 53:137-140.
- Millman SL, Mercado CL, Pile-Spellman ER, Higgins HM, Smith SJ. Accuracy of clip placement using the 11 gauge ultrasound-guided hand-held mammotome device (abstr). *AJR Am J Roentgenol* 2002; 178(suppl):61.
- Parker SH, Kaske TI, Gerhart JE, Dennis MA, Chavez JL. Placement accuracy and ultrasonographic visualization of a new percutaneous breast biopsy marker (abstr). *Radiology* 2001; 221(P):431.
- Eserman LE, Costa D, Kusnick CA, Lowers K. Placement of a new ultrasound (US) visible breast biopsy marker in US-guided 11 gauge directional vacuum assisted biopsy (DVAR) (abstr). *Radiology* 2002; 25(P):459.
- Parker SH, Kaske TI, Dennis MA, Chavez JL, Camp JP. Long term mammographic follow-up of the post-biopsy gelatin pledge/metallic marker (Gel mark) (abstr). *Radiology* 2002; 225(P):512.
- Barnside ES, Sollich RE, Sickles EA. Movement of a biopsy-site marker clip after completion of stereotactic directional vacuum-assisted breast biopsy: case report. *Radiology* 2001; 221:504-507.
- Philpotts LE, Lee CH. Clip migration after 11-gauge vacuum-assisted stereotactic biopsy: case report. *Radiology* 2002; 222:794-796.
- Jackman RJ, Marzoni FA. Needle-localized breast biopsy: why do we fail? *Radiology* 1997; 204:677-684.
- Jackman RJ, Birdwell RL, Ikeda DM. Atypical ductal hyperplasia: can some lesions be defined as probably benign after stereotactic 11-gauge vacuum-assisted biopsy, eliminating the recommendation for surgical excision? *Radiology* 2002; 224:548-554.
- Lechner MC, Jackman RJ, Brem RF, Evans WP, Parker SH, Smid AP. Lobular carcinoma in situ and atypical lobular hyperplasia at percutaneous biopsy with surgical correlation: a multi-institutional study (abstr). *Radiology* 1999; 213(P):106.
- Irfan K, Brem RF. Surgical and mammographic follow-up of papillary lesions and atypical lobular hyperplasia diagnosed with stereotactic vacuum-assisted biopsy. *Breast J* 2002; 8:230-231.
- Brenner RJ. Lesions entirely removed during stereotactic biopsy: preoperative localization on the basis of mammographic landmarks and feasibility of freehand technique—initial experience. *Radiology* 2000; 214:585-590.